CHAPTER 3

MISHAP CAUSES, PREVENTION, AND HAZARD ABATEMENT

The Navy spends millions of dollars each year on damage, fatalities, injuries, and occupational illnesses. Mishaps seriously degrade operational readiness and waste tax dollars. Preventing mishaps depends on identifying, controlling, eliminating, and correcting hazards. When preventive efforts fail and mishaps do occur, investigating them thoroughly helps to determine the causes and prevent recurrences. The lessons learned from a mishap or near-mishap can yield valuable safety information.

What is a mishap? *Mishap Investigation and Reporting* (OPNAVINST 5102.1C) defines a **mishap** as any unplanned or unexpected event causing personnel injury, occupational illness, death, material loss or damage, or an explosion of any kind.

Mishaps are usually a painful experience. After being involved in a mishap, most people look back and say those immortal words, "If only I..." They then finish the statement with "had or had not. . ." With that information in mind, you should work toward making the words *If only I* obsolete. How do you do that? You can't be everywhere at the same time. To prevent mishaps, you have to get people to think about safety. You must promote enough interest to make people want to perform each task safely. We assume most people want to do their best; but remarkably, many people do not associate **best** with **safe.** All Navy personnel must commit themselves to "think smart, think safety."

In this chapter, we discuss various statistics on mishap causes, prevention methods, and hazard abatement.

MISHAP CAUSES

Seldom does a mishap have a simple cause. A combination of factors, coming together under just the right circumstances, usually cause the mishap. A specific chain of events often leads to a mishap. Breaking any link in that chain can usually prevent the mishap. To prevent their recurrence, we need to know what those events and the contributing causes were. Normally, we divide cause factors into the following broad classifications:

1. **Primary cause.** The primary cause, also called the immediate cause, is the actual, obvious cause of the mishap. For example, the cause of the sailor's death was a head injury from a fall down a ladder. The primary cause of death was the head injury.

2. **Contributing causes.** Contributing causes are all the factors that made up the chain of events leading to the primary cause. Only through investigation can we determine these contributing causes. For example, the primary cause of death was a head injury from a fall down a ladder. The contributing causes could have been worn ladder treads, a missing heel on the sailor's shoe, greasy hand rails, the sailor's rushing down the ladder, or many other causes. The primary cause alone does not give you enough information to prevent recurrence of the mishap.

Unsafe acts and conditions are known causes. Knowing how these unsafe acts and conditions develop will make your mishap prevention training more successful.

You can stop mishaps by preventing or eliminating the causes. That is why all hands, especially supervisors, need to understand why mishaps occur. The more you know about the causes of mishaps, the better equipped you will be to prevent them.

A practical definition of a **mishap cause** is anything and everything that has contributed to a mishap. That includes the **primary** and the **contributing causes.** The purpose of this broad interpretation of a mishap cause is to encourage you to adopt a broad and open approach when identifying the cause of a mishap. Thus, do not focus all your attention on the mishap alone. Investigate everything that leads to the mishap both directly and indirectly before determining the probable cause or causes. We categorize causes as follows:

- Human error
- Maintenance and support factors
- Administrative and supervisory factors
- Material failures or malfunctions
- Environmental factors

HUMAN ERROR

Human error causes an **alarmingly high number** of mishaps. Between 50 and 75 percent of mishap investigations conclude that the primary cause of the mishap was human error. Human error findings consider the human involvement before, during, and after the mishap.

We can reduce the number of mishaps by learning to identify and control the human factors that cause mishaps. Human error is part of nearly every mishap. Human error includes the actions of all personnel involved in the mishap. It includes those personnel who may have maintained or repaired equipment or even the worker at the factory where a part was manufactured. Human error involves both physical and mental factors, such as the following:

- Ergonomics (design of the workplace)
- Physical strength and condition of the individual
- Physical stresses and the body's subsequent responses
- Mental factors, including the person's attitude; behavioral factors; ability to retain and assimilate training; external mental stresses, such as interpersonal relationships; and mental illnesses

All of us mentally process information we receive. Factors such as personal experiences, emotions, knowledge, motivation, and attitudes influence how we interpret this information. They also cause us to respond in various ways to different situations. When a mishap occurs, we carefully examine each of these factors. Each one can cause the best trained and most skilled worker to make a wrong decision or response.

ERGONOMICS

Ergonomics refers to the technology involved in helping people physically adjust to their workplace. It is also called biomechanics or the man-machine interface. Basically, ergonomics concerns the design of a workplace, space, or process to minimize stresses on the body and to maximize production. Ergonomics became important with the development of production lines that required constant, repetitive motions.

A workbench that is too high or too low can cause fatigue. Poor lighting can cause confusion. Emergency switches that are out of reach can impair a person from controlling them. All of these work area designs place stress on the body that could contribute to human error.

Controls that an operator cannot reach quickly and easily are examples of poor design. Other examples are emergency controls protected by cumbersome interlocks and displays that are difficult to read and interpret.

Poor functional layout within a space causes inefficient operations and maintenance difficulties, which breed jury-rigged shortcuts. When investigating a mishap, we must look at the work area in which the mishap occurred.

TEMPORARY PHYSICAL ILLNESSES

Temporary physical illnesses, such as colds, flu, dizzy spells, heat stress, and nausea, affect our ability to work safely. These disorders can cause physical impairments that can contribute to mishaps. They can also disrupt concentration, mental alertness, memory, and reasoning ability.

PHYSICAL IMPAIRMENTS

Physical impairments, such as back injuries or hernias, can make people susceptible to mishaps. The weakened physical condition accompanying such defects can impair strength, stamina, and agility.

Mishaps also can stem from two other types of physical impairment—visual and hearing. Good vision is important to every job. A common visual impairment such as faulty depth perception can cause mishaps such as tripping or falling. Hearing impairments can cause mishaps when persons cannot understand audible communications and signals.

ALCOHOL

Alcohol is a chemical depressant. It acts as a general anesthetic for those parts of the brain which suppress, control, and inhibit thoughts, feelings, and actions. Typical effects of alcohol consumption include impaired judgment, unrealistic confidence, and slowed coordination and performance. Such effects bring about risk-taking behavior associated with unsafe acts and mishaps.

DRUG ABUSE

Drug abuse causes many mishaps. Some people die as a result of a drug overdose or respiratory depression caused by barbiturate intoxication. Sailors high on amphetamines and barbiturates sometimes fall

overboard and become lost at sea. Drug abuse or dependence is not only hazardous to the abuser, but also to other personnel, to equipment, and to the operational readiness of the command.

Polydrugs have created still another dimension of drug abuse. The term refers to the mixing of two or more drugs. Mixing alcohol with another drug is the most common form of polydrug abuse. This combination produces effects that can be fatal.

FATIGUE

Fatigue begins when a person starts a task; the fatigue increases as the task continues. It decreases awareness and reflex actions while increasing the chance of error. Symptoms include lower quality of performance, irritability, impatience, forgetfulness, confusion, and increased errors. Hard work long hours, and lack of sleep produce fatigue. In addition, such stresses as vibration, heat, high or constant noise, inadequate illumination, anxiety, boredom, monotony, and change in routine can produce fatigue.

MOTION SICKNESS

Since motion sickness produces severe nausea, it can weaken, distract, or disorient people. The most commonly experienced forms stem from the motions associated with aircraft, cars, trains, and ships. This illness is particularly dangerous because it causes a loss in normal alertness and decision-making abilities. Such a loss can cause a person to make serious mistakes. Once the body becomes adjusted to these movements, through training and adaptation, nausea disappears and normal functioning returns.

EXTREME TEMPERATURES

Extreme temperatures impair a person's overall performance, which increases the chances of inefficiency and mishaps. Heat stress and temperature extremes cause problems such as fatigue, increased reaction time, decreased mental awareness, and loss of dexterity and coordination.

NOISE

Unnecessary or unpleasant noise causes stress by overloading a person's nervous system. Stress can bring about emotional outbursts. Since emotional outbursts are impulsive and unrestrained, they can result in mishaps. Intense noise can cause hearing loss, both permanent and temporary; headaches; fatigue; and nausea. Each of these effects can impair performance.

VIBRATION

We often overlook vibration as a potential source of decreased work performance, and yet it routinely accompanies many activities. Very low-frequency, high-amplitude vibrations can cause motion sickness. Prolonged exposure to vibration commonly produces annoyance and fatigue, which can reduce performance and effectiveness. Exposure to levels of vibration that produce discomfort can induce permanent physical damage to the internal organs.

VISUAL ACUITY

Mishap-free performance requires good visual acuity. Different problems can affect your vision during the day and at night. The most common problem during daylight is glare. Intense light reflected in random directions causes glare. Glare is hazardous because it can momentarily blind you. The blindness can continue for hours until your eyes have had time to adjust to low levels of light.

Even if your eyes adjust easily, your visual acuity at night is not as good as it is during the day. Night vision is extremely sensitive to stray light sources. When your eyes have adapted to darkness, a sudden flash of light can blind you, as glare does during the day. These conditions increase the chances of mishaps.

MENTAL FACTORS

Mental factors have been cited as causes involved in numerous mishaps. Mental factors range from just being in a bad mood to having a serious personality disorder. Although medical professionals usually investigate mental factors, all mishap investigators should look at these factors. In serious mishaps, a medical officer is assigned to determine physical and mental causes of human error. Medical records, prior injuries, responses to stress, and documented personality disorders are reviewed and investigated.

BEHAVIORAL FACTORS

Behavioral factors include actions such as skylarking, risk-taking, showing off, inattention, disregarding instructions or orders, and flaunting authority. Such behavior results when personnel ignore safe work procedures because of undesirable motives.

The following are examples of frequently seen displays of undesirable motives:

- Trying to save time and effort
- Trying to maintain personal comfort
- Trying to express resentment

An undesirable motive is clearly a complex problem. A person does not react simply to the basic needs of comfort, security, belonging, and self-fulfillment. Attitudes, feelings, and emotions stemming from a multitude of sources also affect a person's motives. Chapter 2 discussed attitudes and motivation.

LACK OF TRAINING AND EXPERIENCE

Mishaps caused by a lack of training and experience occur most often when people tackle a task with which they are neither familiar nor qualified. Experienced personnel can clearly recognize hazardous conditions that inexperienced persons may not notice. Since the inexperienced persons' limitations then exceed their capabilities, a mishap may occur.

The imbalance between a person's skills and required levels of training shows through improperly followed procedures, shortcuts, errors in judgment, and improper maintenance and operations. Supervisory personnel sometimes contribute to mishaps by making assignments without adequate knowledge of the capabilities and limitations of their people and equipment.

When you are training inexperienced people for new jobs, their training needs are obvious. They need your help to gain the knowledge and skills they must have to do a job.

Even when you provide people with the basic skills to do a job, they may not thoroughly understand it. They may be unable to retain what you taught them. You must counterbalance this lack of understanding with close supervision.

As people become more experienced and less closely supervised, training deficiencies become more apparent. Finding people placed in tasks beyond their current skill development is not uncommon. When asked if they can handle the assignment, many respond positively. They do not want to appear incompetent.

Knowledge alone is not always enough to prevent a mishap. Most tasks in the Navy require a certain skill level. These skills can vary from those required to paint a bulkhead to those required to operate a nuclear reactor. To properly accomplish any job, people must safely develop skills through practice.

INTERPERSONAL RELATIONSHIPS

Since interpersonal relationships with our peers, supervisors, spouses, and parents can affect our mental attitudes and moods, they can contribute to mishaps. A worker's distraction because of worry about a pending divorce can lead to a mishap. A worker's disregard of an order because of a personality conflict with management or a supervisor can result in a mishap too. To avoid being labeled a "wimp," a person may give in to peer pressure and purposely take risks, such as working without eye protection. That can also result in a mishap.

When you investigate the causes of a mishap, carefully consider the personal lives of the people involved. Are they having problems at home? Are they under pressure because of financial troubles? Could peer interaction possibly have contributed to the cause of the mishap?

MAINTENANCE AND SUPPORT FACTORS

Maintenance and support factors include improper maintenance, improper priority assignments on work requests, or lack of proper quality assurance (QA). Shipyards, intermediate maintenance activities, contractors, or a ship's force may be involved with maintenance and support.

Mishaps can result from the way the manufacturer made, assembled, or installed the equipment. They can result from premature equipment failure caused by a manufacturer's improper processing and fabrication, improper assembly, or use of improper materials. Mishaps can also result from part failures caused by a manufacturer's deviation from design specifications, such as incorrect size, weight, strength, and similar engineering characteristics.

Material damage and personal injury mishaps can result from improperly maintained equipment. A motor incorrectly rewound at a shipyard could short out and cause a fire. Improper QA or the lack of approved QA procedures can result in a mishap. These types of mishaps overlap with human error causes.

ADMINISTRATIVE AND SUPERVISORY FACTORS

Reviewing whether regulations and their enforcement by all levels in the chain of command could have contributed to the mishap is essential during a mishap investigation. Standard operating procedures (SOPs) might be unsafe. Safety standards might be incomplete or missing from a technical manual. How the command views and enforces the use of SOPs and other procedures could contribute to the mishap.

Consider supervisory factors. Examine the proficiency and physical condition of the supervisor. Mishaps can result from an improper level of supervision or a failure to require personnel to meet personnel qualification standards (PQS). They can also result from a lack of formal and informal training of the supervisor and the crew.

Check the adequacy of the procedures and precautions of the task being performed when the mishap occurred. Examine these areas even when every action seems to have been appropriate and to have followed prescribed procedures. You may find procedures are incorrect or inadequate. For example, if you change, replace, or alter a piece of equipment, you must update the technical manual. If you do not, the operator or maintenance technician may accidentally use incorrect procedures for a particular task. Not posting the necessary instructions or removing them from the work area can lead to procedural problems. Instructions need to be available for reference in the work area.

Do not assume personnel already know the precautions to take when doing a job. Make sure they look them up in a procedural instruction or technical manual. Personnel must have these precautions available when needed. Make sure procedures contribute to mishap prevention by teaching personnel to follow the safety precautions for every procedure they perform.

MATERIAL FAILURES OR MALFUNCTIONS

Consider all material failures and malfunctions thoroughly, whether the failures or malfunctions occurred because of faulty design, defective manufacture, or repair. That does not include failures caused by normal wear and tear. Most mishaps blamed on material failure may really involve maintenance factors or human error.

When investigating material failures, especially metal fatigue failures, never try to force the pieces back together. That could alter or destroy the evidence needed for more detailed laboratory analysis.

ENVIRONMENTAL CONDITIONS

Environmental conditions are usually not cause factors. For example, a cause of a mishap might be excessive speed for existing sea conditions or failure to secure for sea; but the high sea state did not cause the mishap. We can attribute very few mishaps to "acts of God." Being struck by lightning maybe an act of God, but being outside during a thunderstorm was a contributing cause; therefore, the mishap was probably preventable.

Environmental factors can damage equipment and cause injury to workers. Environmental factors include extreme exposure to heat, cold, vibration, noise, illumination, radiation, or atmospheric contaminants. You may require electronic equipment to operate within a narrow temperature range, for instance. Deviation degrades performance and causes system failure. Humidity also takes its toll through corrosion and moisture accumulation. Entire systems are susceptible to damage by extreme weather conditions that produce abnormal winds, seas, and rain.

MISHAP PREVENTION

Although a mishap usually has only one primary cause, it may have more than one contributing cause. Alone, each contributing cause may not have caused the mishap. However, one contributing cause may have started a chain of events leading up to the mishap. Preventive efforts must be directed toward all the primary and contributing causes.

Mishap prevention is the process of eliminating mishap-producing causes before a mishap occurs. It is an **organized effort to eliminate unsafe acts** and unsafe mechanical, physical, or chemical conditions. The object of mishap prevention is to prevent mishaps from occurring. If they have already occurred, the object is to prevent them from recurring. Mishap prevention takes place through two means:

- The Navy Occupational Safety and Health Deficiency Abatement Program (NAVOSH-DAP), which identifies a hazard before a mishap occurs and takes action to prevent recurrence
- Mishap investigations, which reveal causes and identify action needed to prevent recurrence

HAZARD PREVENTION

Three methods are used to control the impact of hazards. The first, and preferred, is to prevent the hazard at the design stage. The second is to identify and eliminate existing hazards. The third is to reduce the likelihood and severity of mishaps from hazards that cannot be eliminated.

Hazards may be prevented through appropriate actions during the design process, when operating procedures are developed, and when equipment is purchased. The hazard would never exist if we anticipated problems and eliminated them before they reached the worker. Systems commands are responsible for preventive actions such as system safety reviews, design reviews, and the development of operating and purchasing procedures designed to eliminate hazards.

Usually, ships and shore commands have little control over the design process. If the design of equipment currently in use is hazardous, retrofitting or redesign may be required. If redesigning the equipment is beyond the scope of the activity, it may request help from the systems command or higher authority. The activity can then use that redesign information for future designs and purchases.

Hazards in the workplace may arise as the result of an inadequate preventive maintenance program. An effective preventive maintenance program can keep equipment and material from degrading to the point that they become an operational hazard.

Standard operating procedures (SOPs), instructions, or similar directives that tell how to perform work can prevent hazards from occurring. Obvious examples include SOPs for tank cleaning, foul weather operations, and asbestos removal. Personnel must be familiar with appropriate SOPs and current updates applicable to their duties.

Many hazards may be prevented by including appropriate specifications in purchase orders for equipment/material. Normally, buyers have little control over specifications for equipnlent/material purchased through the Navy supply system. However, since a considerable amount of material/equipment is locally purchased, you can prevent hazards by purchasing the proper types of material in the proper amounts.

Hazardous material is of special concern. We must minimize all local purchases of potentially hazardous material. Afloat commands should purchase only material listed on the Shipboard Hazardous Material List (SHML). Shore commands should purchase only material listed on the Authorized Use List (AUL).

HAZARD CONTROL

When preventing hazards is impossible, we must control their effects by reducing the severity of the hazards. We use several methods to control hazard possibilities. The preferred order in which we use them is (1) substitution, (2) engineering controls, (3) administrative controls, and (4) use of personal protective equipment.

Substitution

Replacing an existing process, material, or equipment with a similar item having a lower hazard potential may reduce risks of injury or illness. Be careful in substituting materials by making sure they are made of technically acceptable materials that will not create a new hazard. Contact NAVSEA/NAVAIR for substitution approval. Naval Supply Systems Command (NAVSUP) must approve hazardous material substitutions.

Engineering Controls

Engineering controls used to control hazards include isolation and ventilation.

ISOLATION.— Isolation is the physical separation of people from contact with a hazard. This method involves the use of a barrier or limiter. It may be in the form of a physical barrier or involve separation by time or distance. Examples include machine guards, electrical insulation, sound barriers, and remote-controlled equipment.

VENTILATION.— Ventilation is the control of potentially hazardous airborne substances through the movement of air. Two methods are **general ventilation** (or dilution ventilation) and **local exhaust ventilation.** General ventilation is the dilution of an airborne substance by mixing it with the surrounding uncontaminated air. Local exhaust ventilation (fig. 3-1) is the removal of an airborne substance at its source or point of generation. This method of ventilation prevents the airborne contaminants from passing through the worker's breathing zone. Local exhaust ventilation is the preferred and more economical method. The use of general ventilation should be limited to the control of heat, humidity, or low toxicity solvent vapors when no other ventilation is possible.

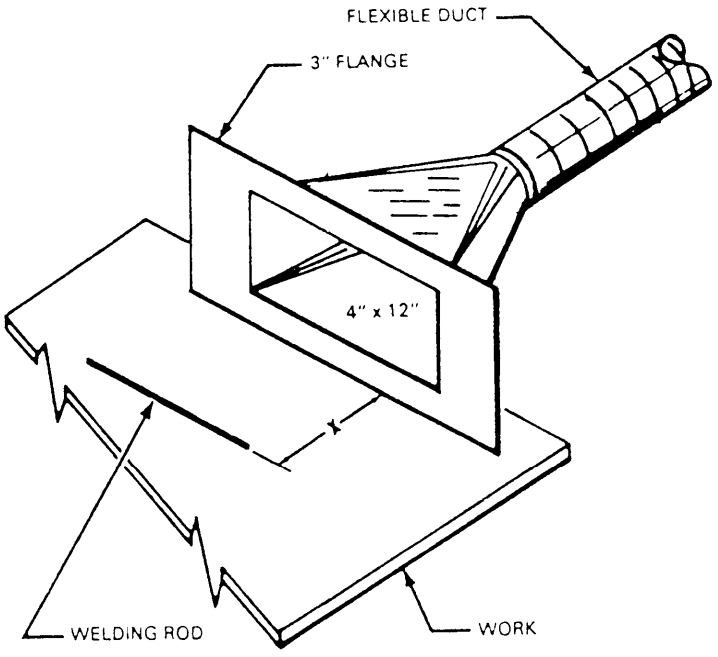


Figure 3-1.—Local exhaust ventilation.

Administrative Control

Administrative control emoploys special operating procedures to reduce the exposure of personnel to hazards. Examples include procedures that limit access to high hazard areas and that provide for adjusted work schedules such as heat stress safe stay times. Another example is an operating procedure requiring the use of semiautomatic equipment that does not require constant attendance (time separation). Adjusted work schedules should be used only when personnel maybe repeatedly exposed to the hazard without adverse effect.

Personal Protective Equipment

The use of personal protective equipment (PPE) is the least preferred method of hazard control. With this method, any equipment breakdown, failure, or misuse immediately exposes the wearer to the hazard. The effectiveness of the PPE also depends on the conscious effort of the user to wear it properly. Nevertheless, when other methods cannot achieve adequate risk reduction, personal protective devices must be used, either alone or in conjunction with other protective measures.

HAZARD IDENTIFICATION

Hazard identification occurs through observation and routine safety program evaluations, surveys, and formal inspections. The safety officer, safety manager, safety petty officer, or safety supervisor trains people to recognize hazards. In chapters 6, 7, and 8, we discuss the program evaluation and hazard identification process for shore, afloat, and aviation activities.

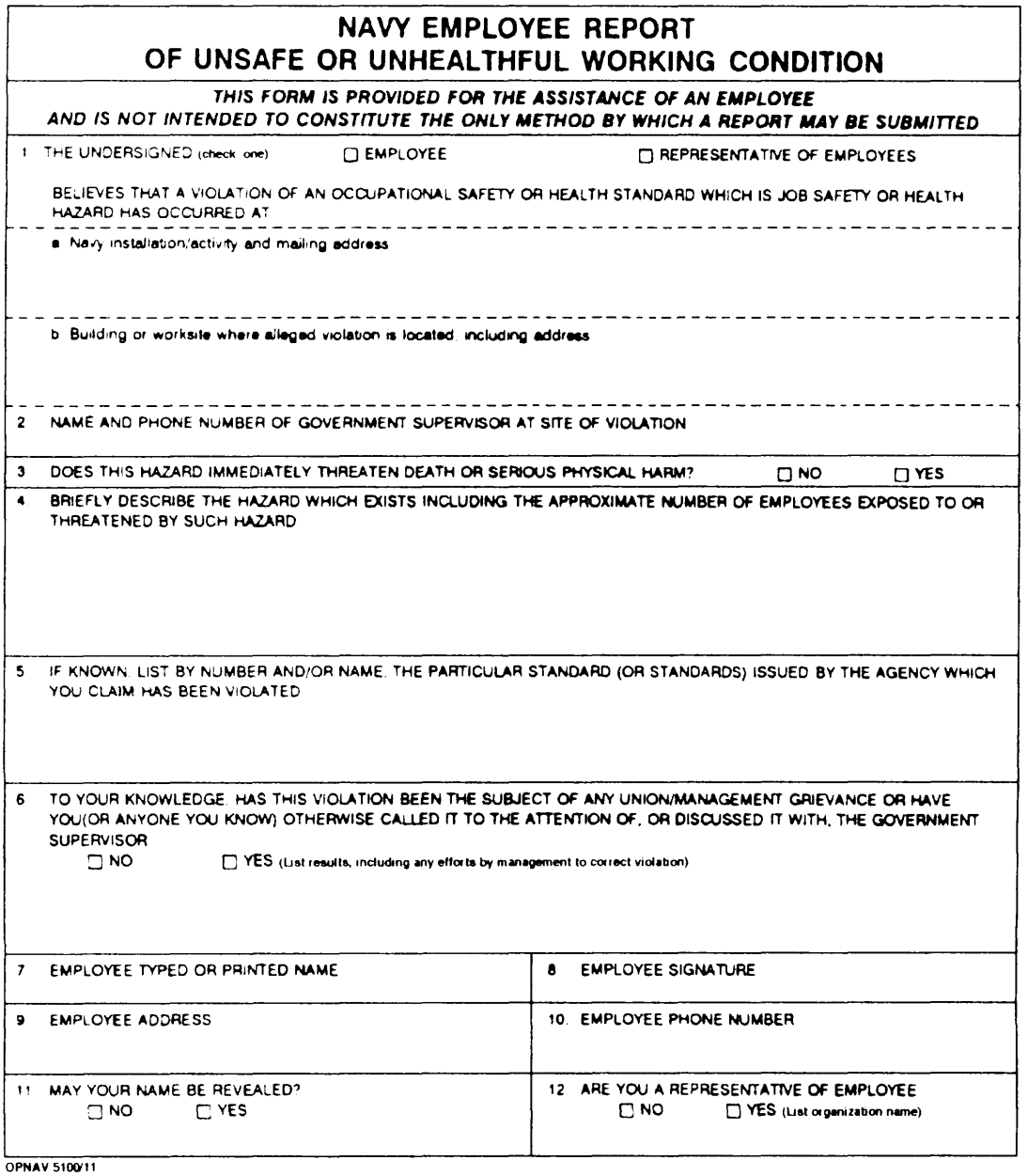
HAZARD REPORTING

The earliest possible detection of unsafe or unhealthful working conditions and the prompt control of hazards identified as a result of those conditions are essential. Encourage your subordinates to submit promptly a report of unsafe or unhealthful conditions.

All personnel should orally report unsafe or unhealthful working conditions to their immediate supervisor. That supervisor should promptly evaluate the situation and take appropriate corrective actions. Supervisors will contact the Occupational Safety and Health (OSH) office, safety manager, division safety petty officer, division officer, or safety officer for assistance, if needed. The person reporting the hazard must be kept informed of all actions taken.

After personnel orally report an unsafe or unhealthful condition, they may expect the supervisor to investigate the situation. If their supervisor takes no action to investigate the condition or they are unsatisfied with the result, personnel may submit a written report.

Ashore, the poster, DD Form 2272, DOD Occupational Safety and Health Protection Program, reminds employees that hazard reporting is their



NAVY EMPLOYEE REPORT
OF UNSAFE OR UNHEALTHFUL WORKING CONDITION

THIS FORM IS PROVIDED FOR THE ASSISTANCE OF AN EMPLOYEE AND IS NOT INTENDED TO CONSTITUTE THE ONLY METHOD BY WHICH A REPORT MAY BE SUBMITTED

1 THE UNDERSIGNED (check one) ☐ EMPLOYEE ☐ REPRESENTATIVE OF EMPLOYEES

BELIEVES THAT A VIOLATION OF AN OCCUPATIONAL SAFETY OR HEALTH STANDARD WHICH IS JOB SAFETY OR HEALTH HAZARD HAS OCCURRED AT

a Navy installation/activity and mailing address

b Building or worksite where alleged violation is located, including address

2 NAME AND PHONE NUMBER OF GOVERNMENT SUPERVISOR AT SITE OF VIOLATION

3 DOES THIS HAZARD IMMEDIATELY THREATEN DEATH OR SERIOUS PHYSICAL HARM? ☐ NO ☐ YES

4 BRIEFLY DESCRIBE THE HAZARD WHICH EXISTS INCLUDING THE APPROXIMATE NUMBER OF EMPLOYEES EXPOSED TO OR THREATENED BY SUCH HAZARD

5 IF KNOWN, LIST BY NUMBER AND/OR NAME, THE PARTICULAR STANDARD (OR STANDARDS) ISSUED BY THE AGENCY WHICH YOU CLAIM HAS BEEN VIOLATED

6 TO YOUR KNOWLEDGE, HAS THIS VIOLATION BEEN THE SUBJECT OF ANY UNION/MANAGEMENT GRIEVANCE OR HAVE YOU(OR ANYONE YOU KNOW) OTHERWISE CALLED IT TO THE ATTENTION OF, OR DISCUSSED IT WITH, THE GOVERNMENT SUPERVISOR
☐ NO ☐ YES (List results, including any efforts by management to correct violation)

7 EMPLOYEE TYPED OR PRINTED NAME	8 EMPLOYEE SIGNATURE
9 EMPLOYEE ADDRESS	10. EMPLOYEE PHONE NUMBER
11 MAY YOUR NAME BE REVEALED? ☐ NO ☐ YES	12 ARE YOU A REPRESENTATIVE OF EMPLOYEE ☐ NO ☐ YES (List organization name)

OPNAV 5100/11

Figure 3-2.-Navy Employee Report of Unsafe or Unhealthful Working Condition.

responsibility. They may use OPNAV 5100/11 (fig. 3-2) to report hazards. Employees should find blank copies of such forms and posted procedures for their use in areas convenient to all workplaces. Employees who wish to remain anonymous should say so on the form.

Upon receipt of a hazard report, the OSH office should contact the originator by telephone to acknowledge receipt of the form and discuss the seriousness of the reported hazard. The OSH office should investigate all reports brought to its attention. Investigations of alleged imminent danger situations are made within 24 hours. Potentially serious situations are investigated within 3 days.

Forces afloat use the Safety Hazard Report (OPNAV Form 3120/5) (fig. 3-3). Personnel my submit a handwritten report that simply states the nature of the condition and its location. An originator who desires that his or her name not be revealed should state so in the report. All personnel should have access to these forms; make sure you educate your personnel in their use.

Upon receipt of a report, the safety officer contacts the originator to acknowledge receipt and discuss the

OPNAVFORM 3120/5

SAFETY HAZARD REPORT

1. ID NO

A. SAFETY OFFICER SECTION

2. ISSUED BY

3. ISSUED TO

4. HAZZARD NOTED

a. DATE

b. TIME

5. RISK ASSESSMENT CODE *(See explanation on back before completing)*

6. LOCATION OF HAZARD

7. NATURE OF HAZARD

B. DIVISION OFFICER SECTION

1. CORRECTIVE ACTION TAKEN

2. INTERIM CORRECTIVE MEASURES

4. NAME, RANK AND TITLE

5. SIGNATURE

6. DATE FORWARDED

C. DEPARTMENT HEAD SECTION

1. ACTION TAKEN

☐ CORRECTIVE ACTION TAKEN IN ITEM B1 ADEQUATE

☐ ADDITIONAL ACTION TAKEN / REQUIRED (GIVE EXPLANATION IN C2)

2. EXPLANATION OF ADDITIONAL ACTION TAKEN / REQUIRED

4. NAME, RANK AND TITLE

5. SIGNATURE

6. DATE FORWARDED

D. RECORD SECTION

1. INITIALS INDICATE ACTION TAKEN IN SECTIONS A, B AND C

TITLE	INITIALS	DATE
SAFETY OFFICER		
EXECUTIVE OFFICER		
COMMANDING OFFICER		

2. IS CSMP ENTRY REQUIRED?

☐ YES ☐ NO

3. IF YES, GIVE NAME OF SHIP BELOW:

USN _____

Figure 3-3.-Safety Hazard Report.

seriousness of the reported condition. The safety officer advises the cognizant division officer that an unsafe/unhealthful working condition has been reported.

Alleged critical danger situations will be evaluated immediately. If possible, potentially serious or moderate situations will be evaluated within 3 days.

The aviation community has its own hazard report (HR) system, covered in OPNAVINST 3750.6Q. Aviation hazard reports (HRs) are used as follows:

- To report a hazard and the remedial action taken so that others can take similar action to eliminate the hazard
- To report a hazard and recommend that another organization take corrective action to eliminate the hazard
- To report a hazard so that some other organization may determine the proper corrective action to eliminate the hazard

Personnel in aviation squadrons and wings must submit an HR whenever they detect a hazard. Command aviation safety programs must encourage personnel to report hazards. Personnel send HRs by mail or message directly to the Naval Safety Center (NAVSAFECEN). The NAVSAFECEN will guard the report's confidentiality and distribute a sanitized report, as it believes necessary. Reports may include recommendations for corrective action within the command.

Four aviation hazards require special formats: bird (and bat) strikes; near mid-air collisions; physiological episodes; and embarked landing hazards. When these hazards occur, but they do not meet the criteria of a defined aircraft mishap, you must submit an HR using the proper, prescribed format.

Hazard Report Responses

The shore OSH office or afloat safety officer will provide an interim or final response in writing to the originator of the reported condition within 10 working days of receipt of the report. Interim responses will include the expected date for a final response. If the evaluation identifies a hazard and its cause, the final response will include a summary of the action taken for abatement of the deficiency. If no significant hazard is found to exist, the reply will include the basis for that determination.

The final response shall encourage the originator to contact the OSH office or afloat safety officer if he or she desires additional information or is dissatisfied with the response. If the originator remains dissatisfied after discussing the matter, the individual must be advised of the right to appeal to the commanding officer.

The commanding officer, or his/her representative, will respond to the originator of the appeal within 10 working days. An interim response will suffice if the evaluation is incomplete at that time. If still dissatisfied, the military or civilian employee has the right to further appeal. Personnel may appeal all the way through the chain of command to the Deputy Assistant Secretary of Defense (DASD) (Environment, Safety& Occupational Health [ES&OH]). Civilians may continue their appeal to the Department of Labor.

Encourage the reporting of hazards, but make sure employees and military members understand that you are taking corrective action. As a supervisor you must take all reports of hazards seriously, no matter how minor.

The Naval Safety Center tracks aviation hazard report corrective actions.

SAFETYGRAM Reports

Aboard ship, safety officers and personnel may submit a SAFETYGRAM, OPNAV 5102/4 (fig. 3-4), to report a hazard, voice a concern, or ask a safety question. They do not need to send the SAFETYGRAM through the chain of command, but can mail it directly to the Naval Safety Center. Usually, this type of hazard reporting is not used for hazards within a particular ship, but for those that may affect other similar units. OPNAVINST 5100.19B, chapter A6, explains how to submit a SAFETYGRAM.

SAFETYGRAMs can be used to report near-mishaps. A near-mishap is an occurrence that, except for proximity or timely action, would have resulted in damage or injury to personnel. While the near-mishap does not cause personnel injury or damage to equipment or material, it does serve notice that a hazardous condition exists. This condition could result in a future mishap. The near-mishap is significant because it can serve as a warning to supervisors of an unsafe condition.

When a near-mishap occurs, personnel can submit a Safety Hazard Report to their supervisor or the command's safety officer. They can also send a SAFETYGRAM to the Naval Safety Center. The safety

SAFETYGRAM

(Mark X in appropriate box to indicate type of Command)

☐ Surface Ship ☐ Submarine ☐ Diving/Salvage ☐ Aviation ☐ Shore

Command, Ship, or Ship Class

References:
Plan No/Tech Manual/etc.

STATE: What, where, why, how it can be prevented or corrected.

SIGNATURE (NOT REQUIRED)

Instructions: (1) Send original to Commander NAVSAFCEN, and copies as appropriate. Retain file copy. (2) May use pencil longhand, attach additional sheets as necessary. (3) If classified information included, follow appropriate marking and handling.

OPNAV 5102/4 (Rev. 8-78) S/N 0107-LF-061-0226 (Replaces NAVSAFCEN 5101-1, 5101/2 and 5101/3 which may be utilized to deplete existing stocks.)

Figure 3-4.—SAFETYGRAM.

INTERNAL MISHAP/NEAR MISHAP INVESTIGATION REPORT

From: _____ Division Officer

To: Commanding Officer

Via: (1) _____ Department Head
(2) Safety Officer
(3) Executive Officer

Date/Time of Mishap: _____ Mishap Category: _____

Location of Mishap: _____

Brief Description of Mishap (Including extent of injury and property damage):

_____

_____

_____

Work/Task Supervisor (at time of mishap): _____

Witnesses: _____

Photos taken (circle one)? YES NO N/A

Cause of Mishap: _____

_____

_____

Corrective Action Taken or Recommended: _____

_____

_____

_____
Signature/Date

_____

2nd Endorsement

Does Mishap Meet External Reporting Requirements (circle one)? YES NO

If yes, indicate the DTG or letter serial number of report: _____
(Attach copy of report)

_____
Safety Officer

RETURN COMPLETED INVESTIGATION REPORT TO SAFETY OFFICER

Figure 3-5.-Internal Mishap/Near Mishap Investigation Report.

officer reports the findings of the near-mishap investigation on an Internal Mishap/Near Mishap Investigation Report (fig. 3-5). If you ignore the conditions that cause near-mishaps, you are sure to invite a real mishap.

Injury Reports

Injury reports and trends in minor injuries can identify hazards and problem areas. Trends may reveal a lack of training, poor enforcement of PPE use, or an incorrect operating procedure.

Reports of injuries are treated as follows:

- Afloat, the medical department treating a crewmember completes an injury report and forwards it to the safety officer for investigation.

- Ashore, the OSH office or command keeps a log of Navy injuries and occupational illnesses (civilian and military ashore). It also submits a quarterly report of Navy and civilian occupational injuries and illnesses, as well as an annual report.

Shore activities also maintain records of all Federal Employees Compensation Act (FECA) claims. These claims can also alert a safety manager to local mishaps and hazard trends.

HAZARD ABATEMENT

Once we have identified and reported a hazard, the next step is corrective action. How do we get it fixed? Some remedies are simple. If someone is not wearing goggles, you provide a pair of goggles. Some corrective actions may be extensive and expensive. Renovation of a ventilation system to remove acid mist may take years. We can take temporary measures to protect workers, but we must take permanent measures to decrease the hazard.

One of the first steps in a hazard abatement program is to prioritize the hazards. That requires assessing the hazard and assigning some type of quantifier. Each identified hazard that cannot be corrected immediately is assigned a risk assessment code (RAC). The RAC represents the degree of risk associated with the deficiency based on the combined elements of **hazard severity** and **mishap probability.** You derive the RAC as explained in the following paragraphs.

HAZARD SEVERITY

The hazard severity is an assessment of the worst potential consequence that is likely to occur as a result of a deficiency. The most unfavorable degree of injury, occupational illness, or property damage defines the "worst potential consequence." The OSH office or safety officer assigns roman numerals to hazard severity categories using the following criteria:

- Category I– Catastrophic: The hazard may cause death or loss of a facility.

- Category II– Critical: May cause severe injury, severe occupational illness, or minor property damage.

- Category III– Marginal: May cause minor injury, minor occupational illness, or minor property damage.

- Category IV– Negligible: Probably would not affect personnel safety or health, but is nevertheless in violation of a NAVOSH standard.

MISHAP PROBABILITY

The mishap probability is the likelihood that a hazard will result in a mishap. The mishap probability is based on the assessment of such factors as location, cycles or hours of operation, and affected population. The OSH office or safety officer assigns an arabic letter to the mishap probabilities according to the following criteria:

- Subcategory A: Likely to occur immediately or within a short period of time.

- Subcategory B: Probably will occur in time.

- Subcategory C: May occur in time.

- Subcategory D: Unlikely to occur.

RISK ASSESSMENT CODE

The risk assessment code (RAC) is an expression of risk that combines the elements of hazard severity and

Table 3-1.—Risk Assessment Code (RAC)

A. Risk Assessment. Each identified/validated hazard shall be assigned a Risk Assessment Code (RAC) by the activity safety office. The RAC represents the degree of risk associated with the deficiency and combines the elements of hazard severity and mishap probability. The RAC is derived as follows:

1. Hazard Severity. The hazard severity is an assessment of the worst potential consequence, defined by degree of injury, occupational illness or property damage which is likely to occur as a result of a deficiency. Hazard severity categories shall be assigned by Roman numeral according to the following criteria.

(a) Category I - Catastrophic: The hazard may cause death, or loss of a facility.

(b) Category II - Critical: May cause severe injury, severe occupational illness, or major property damage.

(c) Category III - Marginal: May cause minor injury, minor occupational illness, or minor property damage.

(d) Category IV - Negligible: Probably would not affect personnel safety or health, but is nevertheless in violation of a NAVOSH standard.

2. Mishap Probability. The mishap probability is the probability that a hazard will result in a mishap, based on an assessment of such factors as location, exposure in terms of cycles or hours of operation, and affected population. Mishap probability shall be assigned an Arabic letter according to the following criteria:

(a) Subcategory A - Likely to occur immediately or within a short period of time.

(b) Subcategory B - Probably will occur in time.

(c) Subcategory C - May occur in time.

(d) Subcategory D - Unlikely to occur.

3. Risk Assessment Code (RAC). The RAC is an expression of risk which combines the elements of hazard severity and mishap probability. Using the matrix shown below, the RAC is expressed as a single Arabic number that can be used to help determine hazard abatement priorities.

HAZARD SEVERITY	MISHAP PROBABILITY			
	A	B	C	D
Category I	1	1	2	3
Category II	1	2	3	4
Category III	2	3	4	5
Category IV	3	4	5	5

RAC	
1	- Critical
2	- Serious
3	- Moderate
4	- Minor
5	- Negligible

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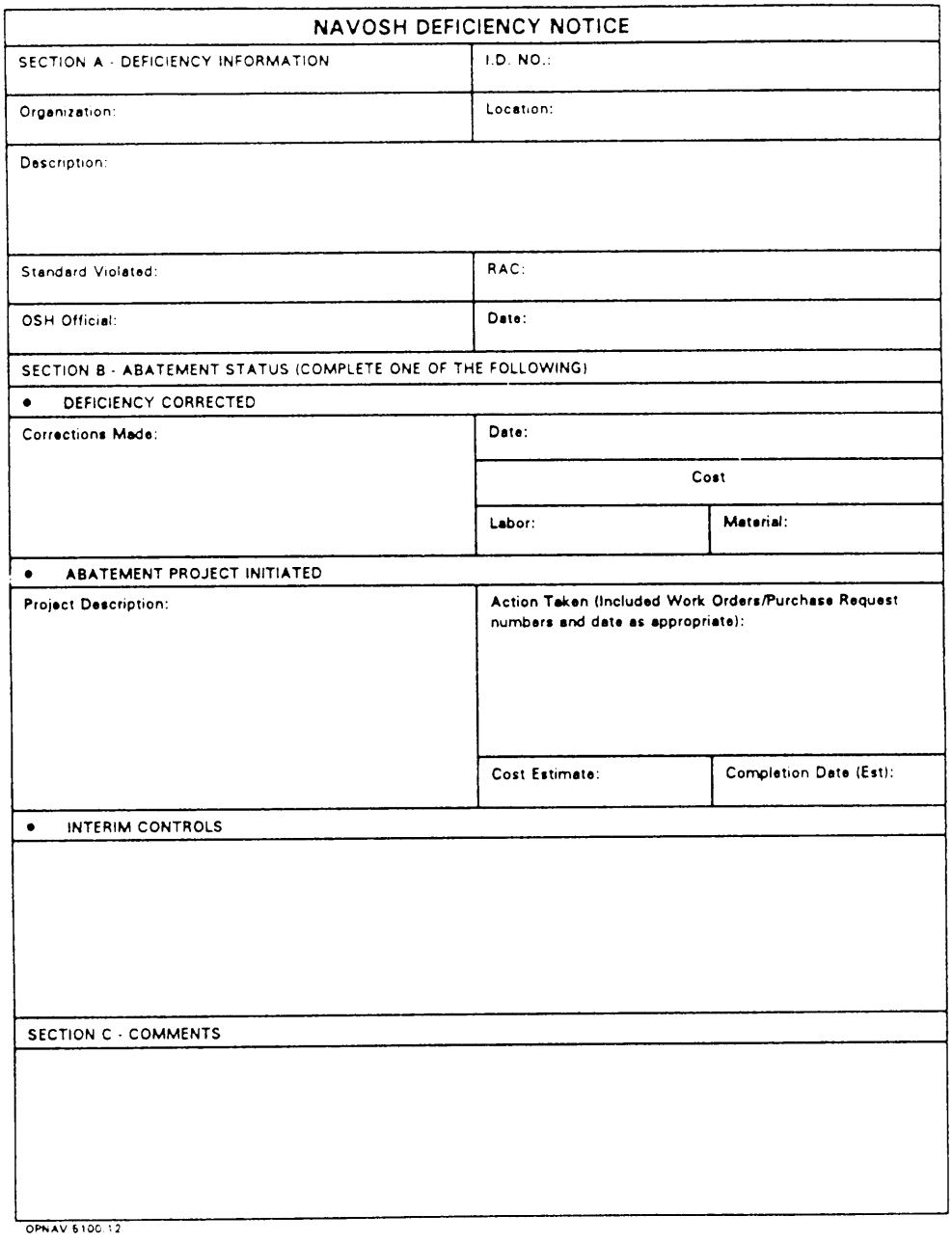
mishap probability. Using the matrix in table 3-1, we express the RAC as a single arabic number that we use to help determine hazard abatement priorities. RACs are used on the various hazard reports, mishap reports, and mishap investigation reports.

NAVOSH DEFICIENCY NOTICE

Ashore, civilian and military hazard correction is documented on a NAVOSH Deficiency Notice, OPNAV 5100/12 (fig. 3-6). Section A describes the



NAVOSH DEFICIENCY NOTICE

SECTION A - DEFICIENCY INFORMATION | I.D. NO.:

Organization: | Location:

Description:

Standard Violated: | RAC:

OSH Official: | Date:

SECTION B - ABATEMENT STATUS (COMPLETE ONE OF THE FOLLOWING)

• DEFICIENCY CORRECTED

Corrections Made: | Date:

Cost

Labor: | Material:

• ABATEMENT PROJECT INITIATED

Project Description: | Action Taken (Included Work Orders/Purchase Request numbers and date as appropriate):

Cost Estimate: | Completion Date (Est):

• INTERIM CONTROLS

SECTION C - COMMENTS

OPNAV 5100.12

Figure 3-6.—NAVOSH Deficiency Notice.

hazard/deficiency. The activity safety office forwards a copy to the official in charge of the operation where the deficiency occurs. Copies of OPNAV5100/12 for RAC 1, 2, and 3 deficiencies must be posted in the area of the deficiency until the hazard has been abated.

The official in charge of the operation takes prompt action to correct the deficiency. Within 30 days of the date of the notice, he or she completes section B and returns a copy to the activity safety office. Work areas awaiting permanent abatement initiate interim protective measures. The report should show the status of the deficiency in one of the following categories:

- The deficiency has been corrected
- An abatement project has been initiated.

INSTALLATION HAZARD ABATEMENT PLAN

Ashore, a formal installation hazard abatement plan records deficiencies assigned RACs 1, 2, and 3 that

require more than 30 days for correction. This plan should include the following standard data for each deficiency (or logical grouping of similar deficiencies):

- Dates of hazard identification
- Location of the hazard(s)
- Description of the hazard(s), including reference to applicable standards
- Estimated RAC (with hazard severity, probability of single occurrence, and annual personnel exposure cited separately) or calculated RAC
- Interim control measures in effect
- Description of the abatement action, including estimated cost and completion date
- Closeout statement, showing: completed abatement action and actual cost, with date of completed action; or process discontinued or work site vacated

The installation abatement plan is available for review locally by recognized employee organizations, where applicable.

AFLOAT HAZARD ABATEMENT PLAN

The safety officer usually maintains a record or some type of log of safety hazard reports. This log is recommended but not required. This log can be used to track hazards that arc corrected immediately or quickly. Hazards that require additional time to correct are entered into the 3-M Systems. Such hazards/ deficiencies should be the subject of a 4790/2K and entered into the current ship's maintenance project (CSMP).

A safety hazard code, similar to an RAC, is placed in block 15 of the OPNAV 4790/2K; the safety hazard is explained in the Description/Remarks block. The CSMP is the Hazard Abatement Plan for forces afloat. Option "D" of the CSMP lists the OPNAV 4790/2Ks that were marked as safety hazards. The safety officer maintains the CSMP listing of NAVOSH hazards/deficiencies that require authorization of funding by higher authority. A ship, shipyard, or intermediate maintenance activity that has NAVOSH deficiencies it cannot correct should submit a request to the type commander for either an alteration equivalent to repair or a ship alteration.

INTERIM HAZARD CORRECTION

We recognize that immediate abatement of deficiencies in working conditions may not always be possible and that some temporary deviation from NAVOSH standards may be required. Therefore, you must establish appropriate interim controls as soon as you note the deficiency. Ashore, you should document such controls on the NAVOSH Deficiency Notice as prescribed in chapter 9 of OPNAVINST 5100.23C. The activity safety office approves interim protective measures in effect for more than 60 days. Afloat, the interim action should be documented on the Safety Hazard Report. For an RAC 1 (critical) or 2 (serious) hazard, the commanding officer must personally approve the interim control.

When you must delay correcting an unsafe condition for reasons such as a shortage of funds, personnel, or equipment, take appropriate temporary precautions to protect workers until the correction is made. Such precautions may include securing hazardous areas, disconnecting power sources, removing equipment from service, posting warning signs, or even verbally warning workers of the hazardous condition. Take temporary precautions promptly to reduce the hazard to personnel.

We need to address your authority to correct unsafe conditions at this point. Sometimes an unsafe condition may arise that requires immediate corrective action because it poses an immediate danger to life or limb. We call that an imminent danger situation. Act as your judgment tells you to act to meet the emergency. **Do not delay!** Do not worry about whether or not you have the authority. YOU HAVE IT!

HAZARD AWARENESS DEVELOPMENT

When we were young, adults tried to prepare us to live safely. They cautioned us over and over about the hazards we would encounter. "Look both ways before you cross the street." "Never swim alone." "Stay out of the medicine cabinet." These are some of the safety-related litanies adults repeated to us day in and day out. In school, our teachers also gave us safety instructions. Today, we are still learning about hazards.

As we grew, our own experiences made the warnings we received by word of mouth even more vivid. We slipped in the bathtub, broke our toys, cut ourselves with knives, damaged our bicycles, and soon. We not only encountered hazards, but experienced the results of failing to heed warnings about hazards.

Since we obviously cannot expect to experience everything in life ourselves, we must learn from the experiences of others. We need to heed the lessons learned by those who have gone before us.

Safety precautions and operating instructions provide documentation of experiences that teach us clear lessons. By heeding these precautions and instructions, we can prepare ourselves to live successfully and safely in our everyday environment.

We can learn about mishap prevention from actual mishaps. Experience shows what went wrong and how often. It also shows what has to be done to correct a potential mishap problem. Safety rules and operation and maintenance procedures and practices reflect lessons learned from past mishaps.

Environment, equipment design, or lack of finding or training increases the hazards of some conditions. For example, the best setting for a piece of equipment and its operator is a stable platform. However, the shipboard environment cannot always provide the ideal setting.

The environment of a naval ship is potentially dangerous. Fuel, ammunition, high temperatures, electrical circuits, steel decks, salt water, ladders, voids, and machinery create conditions that can catch the unwary. In the aviation community, high-performance aircraft make the hazards even greater. Everyone in the Navy must be aware of these hazards.

Make sure you provide hazard awareness training. The hidden hazards are the ones that often cause mishaps. Routine tasks may lull people into a false sense of security; they may then be tripped up by something that appeared irrelevant or that they did not notice. A detailed review of the conditions that existed at the time of a mishap might reveal hazards that would have been obvious to the trained observer.

Teach people that they should not take risks when they suspect something is wrong or take shortcuts to avoid the inconvenience of safe practices. Make them realize that a disabling injury or lost or damaged equipment is much more inconvenient in the long run.

Use formal and on-the-job training to develop hazard awareness. Measure that awareness by the ability of your people to identify hazards. Although you can teach people to identify known hazards, you may have difficulty teaching them to recognize hidden hazards. Their skill level, experience, attitude, and sense of responsibility may affect their ability to identify hidden hazards. You must be able to recognize and evaluate those areas that affect your people's ability to learn. You must be able to teach others what you know and what you have learned through experience.

As a result of changing technology, the working environment constantly undergoes new developments and receives new equipment. Therefore, in spite of conscientious mishap prevention, you must always watch for hazards in the work environment. Hazards may exist because of mistakes made by others or because of your own behavior. Although hazard awareness training teaches people to be more observant of hazardous conditions, it requires a certain amount of self-awareness by the trainee. Education, training, and experience improve the trainee's awareness.

SUMMARY

In chapter 1 we reviewed safety training requirements. In chapter 2 we discussed safety attitudes and promoting a safety program. All of that information involves hazard awareness.

This chapter exposed you to some of the causes of mishaps and ways to prevent them. For further information and guidance, you may find the following references in Appendix I helpful. Remember, take steps to prevent mishaps BEFORE they happen.